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Successive Multisite Peripheral Nerve Catheters for Treatment of Complex Regional Pain Syndrome Type I

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KEY WORDS

complex regional pain syndrome, continuous peripheral nerve blockade

ABBREVIATION

CRPS—complex regional pain syndrome

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abstract

Complex regional pain syndrome (CRPS) type I is a painful and disabling syndrome that is accompanied by physical changes in the affected extremity. It generally occurs after trauma, manifesting as pain that is out of proportion to the inciting event. Treatment of the disorder is difficult, with many patients being refractory to multiple pharmacologic regimens. Regional anesthetic techniques, including neuraxial blockade, sympathetic blockade, Bier block, or peripheral nerve catheters, have been used with varying degrees of success. We describe, for the first time, the use of multiple peripheral nerve catheters to treat CRPS type I in a 10-year-old girl when multimodal pharmacologic regimens failed. At separate times, a peripheral nerve catheter was placed to treat CRPS of the distal left lower extremity as well as the right upper extremity. The goal of this therapy was to relieve pain and thereby allow the reinitiation of intensive physical therapy. A continuous infusion of 0.1% ropivacaine was infused via the catheters for ~60 hours. The patient was subsequently able to participate in physical therapy as well as activities of daily living with improved eating, sleeping, and mood. Although many therapeutic modalities have been tried in CRPS type I, given the debilitating nature of the disorder and the variable response to therapy, new and alternative therapeutic interventions, such as continuous peripheral nerve catheters, are needed. *Pediatrics* 2013;131:e323–e326

Complex regional pain syndrome (CRPS) type I is defined as a painful and disabling syndrome accompanied by physical changes in the affected extremity, including allodynia, edema, and alopecia, as well as sudomotor and vasomotor dysfunction.¹ It generally occurs after trauma, although the pain is generally out of proportion to the inciting event. Although reported most frequently in the adult population, it is being recognized with increased frequency in the pediatric population.² The exact pathophysiology of CRPS is not clearly understood, but is thought to be mediated by local dysfunction of sympathetic activity and dysfunction of local autonomic nervous system activity.³ Patients afflicted with CRPS can be incapacitated, with a significant impact on their quality of life. There are many signs and symptoms related to CRPS. Table 1 represents clinical diagnostic criteria for CRPS as proposed by the Budapest International Association for the Study of Pain consensus group.⁴ Various treatment regimens have been used, including physical therapy, behavioral measures, transcutaneous electrical

nerve stimulation, and pharmacologic therapy, including antidepressants or anticonvulsants. Others have used regional anesthetic techniques, including neuraxial blockade, sympathetic blockade, Bier block, or peripheral nerve catheters.²⁻⁷ We report for the first time the use of multiple peripheral nerve catheters in the treatment of CRPS type I in a pediatric patient.

CASE REPORT

Institutional review board approval is not required at Nationwide Children's Hospital for the presentation of single case reports. The patient was a 10-year-old, 42-kg girl with CRPS type I of her left foot and right elbow related to separate traumatic events that included having a bed dropped on her foot and her arm shut in a car door. She is an excellent student with a stable home environment with both parents present. The elbow injury occurred ~1 month before this admission and her foot injury ~3 months prior. Her physical examination and clinical course were diagnostic of CRPS type I. She had been discharged from the hospital 5 days previously, after a 14-day in-hospital treatment of the CRPS type I of the right elbow. During that hospitalization, she had foot pain that was associated with signs and symptoms of CRPS type I, but she was limited by her shoulder pain. Attempted pharmacologic therapies during her previous hospitalization included amitriptyline (50 mg at bedtime), a prednisone burst with taper (dose began at 40 mg daily and was tapered over 5 days), diazepam (5 mg every 6 hours as needed for spasms), pregabalin (100 mg twice daily), and hydromorphone patient-controlled analgesia (0.2 mg every 20 minutes). The psychiatric consult service was involved on a daily basis. Aggressive physical therapy was attempted and failed because of her inability to participate. Additional

therapies that had failed included massage therapy, acupuncture, transcutaneous electrical nerve stimulation unit therapy, Child-Life involvement, and therapeutic recreation. As she had failed multiple therapeutic interventions, a supraclavicular peripheral nerve catheter was placed by using real-time ultrasound guidance. The catheter was dosed with a continuous infusion of 0.1% ropivacaine at 6 mL/hour after a bolus of 10 mL of 0.2% ropivacaine. Immediately post-procedure, she was able to participate in physical therapy passively, as she had a motor block of the brachial plexus for ~6 hours. After her motor block, she was able to participate in both active and passive range of motion exercises. Pain scores before the procedure ranged from 6 to 10 of 10, with a median score of 7 to 8 during the day. Postprocedure pain scores ranged from 0 to 4 (median 1-2). The hydromorphone patient-controlled analgesia was discontinued, whereas the other therapies were continued. The supraclavicular catheter was left in place for ~60 hours. She was discharged from the hospital 4 days after catheter placement with no complaints of pain in the upper extremity. She was discharged on amitriptyline 50 mg at night, hydrocodone-acetaminophen 5/325 mg as needed every 6 hours, naproxen 220 mg twice daily, pregabalin 100 mg twice daily, and diazepam 5 mg every 8 hours as needed for muscle spasms.

She was readmitted to the hospital 5 days later with uncontrolled pain, swelling, and color changes of the left lower extremity that manifested after what she described as an "intense" session of physical therapy. Full range of motion of her right elbow was intact actively and passively. She denied pain in the previously affected arm. The patient had her left leg suspended off

TABLE 1 Signs and Symptoms of CRPS

Sensory	<ol style="list-style-type: none"> 1. Burning pain disproportionate to inciting event, worse when in dependent position 2. Stimulus-evoked pain (mechanical and thermal allodynia and hyperalgesia) 3. Symptoms are worst distally and not in relation to specific nerve innervations or to site of inciting event
Autonomic	<ol style="list-style-type: none"> 1. Skin temperature changes 2. Swelling 3. Increased or decreased sweat production 4. Vasomotor abnormalities
Trophic	<ol style="list-style-type: none"> 1. Abnormal nail growth 2. Increased or decreased hair growth 3. Fibrosis 4. Thinned skin that has glossy appearance 5. Diffuse demineralization as seen on radiograph, osteoporosis
Motor	<ol style="list-style-type: none"> 1. Weakness 2. Dystonia

the bed and refused to allow an examination. The physical findings of the lower extremity were diagnostic of CRPS type I. Her current medications included pregabalin, which was increased to 100 mg every 8 hours, diazepam 5 mg orally every 6 hours as needed for spasms, and amitriptyline 50 mg at bedtime; clonidine 0.1 mg orally twice a day was added. Patient-controlled analgesia by using hydro-morphone was initiated at 0.2 mg every 20 minutes in conjunction with oral oxycodone 5 mg every 4 hours. Over the next 3 days, she reported the inability to sleep and ambulate even to the bathroom, and she refused to eat. Physical therapy was impossible because of her discomfort, despite a daily opiate use of 10 to 12 mg of hydro-morphone. Because of continued failed multimodal aggressive therapy, with informed consent from the patient's mother, we elected to place continuous lower extremity peripheral nerve catheters. These catheters were placed 9 days after removal of the supra-clavicular nerve block. By using real-time ultrasonography, femoral and sciatic peripheral nerve catheters were placed under general anesthesia. The catheters were each dosed with a bolus dose of 0.5% ropivacaine followed by a continuous infusion of 0.1% ropivacaine (femoral at 6 mL/h and the sciatic at 9 mL/h) via an elastomeric infusion device (Ambu, Glen Burnie, MD). In the postanesthesia care unit, the patient rated her pain as 2 of 10 as compared with 7 to 10 of 10 pre-operatively. She did not react to palpation of her lower extremity. There was an immediate improvement in the color of the extremity and the swelling was also markedly improved. She had complete motor block in the femoral and sciatic nerve distributions throughout the night. The next morning she was able to move her toes and foot without pain. She began physical therapy twice daily with active and passive range of

motion exercises and was placed on fall precautions while her catheters were infusing local anesthetic. She was transitioned from the parenteral opioids to as-needed oral opioids, which she did not use for the first 48 hours of catheter therapy. The peripheral nerve catheters were removed after 60 hours of therapy. Her amitriptyline and pregabalin doses were adjusted and she was discharged from the hospital 4 days after catheter placement with minimal swelling, improved color, and improved mobility, and was participating in physical therapy. She was discharged on amitriptyline 25 mg in the morning and 50 mg at night, oxycodone 5 mg as needed every 6 hours, pregabalin 150 mg 3 times daily, and diazepam 5 mg every 8 hours as needed for muscle spasms. Since discharge, she has continued physical and massage therapy regularly. She is requiring an oral opioid less than once a day. She has yet to be hospitalized again for CRPS-related pain. She continues to be seen in the chronic pain clinic with minimal changes in medications since discharge.

DISCUSSION

Continuous peripheral nerve catheters have seen increased use in the adult population after major surgical procedures of the upper and lower extremities.^{8,9} The ease of placement and safety of such techniques has been facilitated by using ultrasound imaging. Although still in limited use, this technique is being applied to the pediatric population as an effective means of controlling postoperative pain in the inpatient and outpatient settings.¹⁰ Risks related to peripheral nerve blockade include nerve damage, vascular catheter placement or intravascular injection of local anesthetics, local infection, and falls. In this patient with multiple catheters of the lower extremity, the risk for falls is realistic.

We report, for the first time, the use of multiple peripheral nerve catheters to treat CRPS type I in 2 different extremities in a 10-year-old girl. Therapy resulted in prompt pain relief, resolution of the physical changes associated with CRPS type I, and a reduction in the need for pharmacologic adjuncts, including parenteral and oral opioids. Effective pain relief allowed our patient to participate fully in physical therapy and an exercise regimen.

Although lumbar sympathetic blockade can be used to treat CRPS, the technique of such blockade is more challenging and, unlike peripheral nerve blockade, generally not in the repertoire of practicing pediatric anesthesiologists.¹¹ Furthermore, with the advent of equipment tailored to the needs of pediatric patients and the use of ultrasound, these techniques now can be easily applied to the pediatric population. An additional advantage, when compared with lumbar sympathetic blockade or a Bier block, is that a peripheral nerve catheter permits the continuous and ongoing infusion of a local anesthetic to provide analgesia for days, thereby facilitating physical therapy, which is crucial to recovery of these patients.¹² Peripheral nerve catheters offer the advantage over continuous epidural infusions in that they are applicable in upper extremity disease, offer unilateral anesthesia, provide a limited and localized sympathetic blockade, and do not affect bladder or bowel function. This case highlights the difficulty in the treatment of CRPS type I and the importance of an interdisciplinary approach. The use of invasive therapies should be limited to those patients in whom aggressive multimodal therapies fail. Although many modalities have been tried in CRPS type I, given the debilitating nature of the disorder and the variable response to therapy, new

and alternative therapeutic interventions, such as continuous peripheral

nerve catheters, are needed. Whenever such techniques are used,

adherence to local anesthetic guidelines is mandatory to avoid toxicity.

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